Errata to *Elements of Statistical Computing*

Ronald Thisted
Last revised: 11 September 2009

This is a fairly complete listing of bugs and errors in ESC (I hope!). From the moment the proofs left for the printers I began compiling in my own copy a set of corrections discovered by myself and readers who kindly brought their discoveries to my attention. Unfortunately, the copy of the book with my master set of emendations was stolen. This set back the compilation of an Errata sheet for some time. I have tried to reconstruct from notes as many of the discovered errors as possible. In each case, the first finder of each error (except for intentional ones) is noted below.

In references to line numbers, negative numbers are line counts from the bottom of the page. Lines marked with a double asterisk are substantive corrections, which probably warrant annotation in your copy of the book.

In an effort to discover (and correct) as many remaining errors as possible, I will gladly pay $1.00 to the first finder of each error not already listed below. Comments and suggestions can be sent to me via electronic mail at `r-thisted@uchicago.edu`. Be sure to include your name and surface mail address (to receive your finder's fee). Decisions of the judge (RT) are final.

Throughout:

Capitalization of section references throughout the book is inconsistent. Each instance should capitalize the word "Section"

[*Ernesto M. Flores-Roux, RT, others*]

Throughout:

Standardize usage of non-zero vs nonzero, semi-definite vs semidefinite, multi-dimensional vs multidimensional, non-distinct vs nondistinct, etc.

[*Ernesto M. Flores-Roux, RT, others*]

Throughout:

The term "Householder rotation" should be replaced with either the term "Householder reflection" or "Householder transformation," depending on context.

[*Douglas Bates, others*]

Throughout:

"Upper-triangular" and "lower-triangular" should not be hyphenated.

[*RT*]

Page xix, Headings for Part V and Part VII:

"Computation" should be capitalized

[*RT 1/11/88*]

Page 9, 10, 203, 343, 346:

The format used for presenting algorithms varies throughout the book. It shouldn't. The algorithms appearing on the pages cited above should be reformatted in the style of other algorithms, such as those on pages 170–171. The word "Algorithm" and any identifying information should be in boldface and left justified, followed by a colon, and placed on a line by itself.

[*Ernesto M. Flores-Roux, RT 4/90*]

****Page 10, line 3:**

Should read, "Moreover, Algorithm A as written requires $3n$ additions and subtractions, ..." [Algorithm A is easily modified to require only $3n - 2$, not counting the calculation of $n - 1$, which is an integer, not floating-point, operation.]

[*Lynn Friedman 3/31/88*]

Page 10, Algorithm B:
Omit the period after "**end**," and add a line that reads:
$s^2 := (sq\_sum - [sum^2/n])/(n-1)$.
[*Ernesto M. Flores-Roux 3/29/90*]

Page 10, Algorithm B:
Omit **begin** and **end**
[*RT 4/6/90*]

Page 10, Algorithm C:
Change $s2$ to s^2.
[*Ernesto M. Flores-Roux 3/29/90*]

Page 10, Algorithm C:
Omit closing period.
[*RT 4/6/90*]

Page 10, lines 1–2 after Algorithm B:
Should read, "This algorithm requires only $2n+1$ additions and subtractions, and only $n+2$ multiplications and divisions,...."
[*Lynn Friedman 3/31/88*]

Page 13, line -11:
Change "affords" to "afford"
[*Fred Wright 4/5/90*]

Page 19, line 21.:
Change "require" to "requires"
[*Fred Wright 4/5/90*]

Page 20, line -11:
Should read "formulæ to"
[*Michael Frigge 4/19/88*]

Page 24, line 12:
"manipulation" should be plural.
[*Michael Frigge 4/19/88*]

Page 26, line 5:
Should read: "Thus, MACSYMA is a program *that* computes...."
[*RT 3/26/90*]

Page 28, line 9:
Should read, "Some problems *that* arise...."
[*Ernesto M. Flores-Roux 4/6/90*]

Page 32, line 1:
"formulae" should read "formulæ"
[*Michael Frigge 4/19/88*]

Page 35, lines 6–10:

Should read:

> Of the 32 bits in a single word, the first bit is the sign, the next 7 bits are devoted to the exponent, which is an integer in *excess-64* notation; if the binary value of this integer is k, then the exponent it represents is $k - 64$. The remaining 24 bits contain ....

[*Michael Frigge 4/19/88*]

Page 37, line -16; Page 59, line -2:

Add missing reference in bibliography.

[*RT 1990?*]

Page 37, line -8:

Should read: "...our exposition follows ...."

[*Michael Frigge 4/19/88*]

Page 8, line 8:

Change β^{-t} to $\beta^{-(t-1)}$.

[*Brad Carlin 1/13/99*]

Page 39, line -1:

Delete period after "f^*"

[*Ernesto M. Flores-Roux 4/6/90*]

Page 44, line 6 of Section 2.3.1:

omit semicolon following $s := 0$ (for consistency with other algorithms). [In rethinking the issue, the semicolon appears correctly as required by Pascal syntax. Since this is billed as a Pascal code fragment, the semicolon should remain. The confusion came with similarly-appearing algorithms, which were intended to be written in pseudocode rather than executable Pascal (or any other language). The second edition will distinguish between the two, and algorithms will be expressed in a more formal and less ambiguous way. —RT]

[*Ernesto M. Flores-Roux 4/6/90*]

Page 44, line 11 of Section 2.3.1:

Place Pascal fragment on its own indented line.

[*RT 4/18/2004*]

Page 44, line -4:

The reference to Section 3.1 should be to Section 2.1.

[*RT 4/16/2004*]

Page 45, line above Equation (2.3.1):

"$f^{=}x$" should read $f = x$.

[*RT 1/11/88*]

Page 45, expression (2.3.2):

The expression $|x_{\max}|$ should be $|x|_{\max}$.

[*Brad Carlin 1/13/99; Walter Ambrosius 4/2/92*]

Page 47, 73, 165, 167:

For consistency, algorithms on the pages cited above should not contain any concluding punctuation unless required by context. (But Algorithm 2.3.3 on page 47 and expressions (3.2.8) on page 78 and (3.3.4) on page 83 *do* need a period, since they end sentences!)

[*Ernesto M. Flores-Roux, RT 4/90*]

Page 47, Algorithm 2.3.3:
Omit **end**
[*RT 4/6/90*]

Page 48, line 6:
The period following "(200,1)" should be chanaged to a comma.
[*RT 4/17/2004*]

Page 49, line -10:
Add the word "and" before "those computed by. . . ."
[*Ernesto M. Flores-Roux 4/6/90*]

Page 49, line -3:
Change "introduce" to "introduced" (for consistency).
[*Ernesto M. Flores-Roux 4/6/90*]

Page 50, line -9:
Add space between "formulæ" and "in".
[*Peter McCullagh 3/14/88*]

Page 52, line 2 of comment:
Change "*weighted*" to Roman type
[*RT 4/6/90*]

Page 52, line -5:
replace the words "*weighted* mean" by "weighted version of $\bar{X}$ just defined."
[*Ernesto M. Flores-Roux 4/6/90*]

Page 54, Exercise 2.16:
Capitalize "algorithm"
[*RT 3/29/90*]

Page 54, Exercise 2.16:
The algorithm should refer to Algorithm 2.3.3 rather than 3.2.3.
[*RT 4/18/2004*]

Page 56, line -5:
Add transpose to definition of e, that is, $e = (1, 1, \ldots, 1)'$.
[*Craig Borkowf 4/20/90*]

Page 57, line -16:
Add space, to read "(IEEE, 1985)."
[*RT 3/27/90*]

Page 59, line 17:
Add space between sentences
[*Ernesto M. Flores-Roux 4/6/90*]

Page 64, equation (3.1.8):
The comma following ϵ_2^* should follow the entire expression
[*Stuart Luppescu, 4/9/92*]

Page 65, line 14 (and elsewhere):
The term, "Householder rotation" should be replaced by the term, "Householder transformation"
[*Douglas M. Bates, 2/10/92*]

Page 65, line -8:
"by rotating it to make . . . zero." should be replaced by "by making . . . zero while preserving its length."
[*RT 4/17/2004*]

Page 66, line 13:
Omit ", or rotation"
[*RT 4/17/2004*]

Page 67, line 8:
Change "rotation" to "reflection"
[*RT 4/17/2004*]]

Page 68, line 7 of Section 3.1.4:
Add comma after the word "conceptually"
[*Ernesto M. Flores-Roux 4/6/90*]

Page 68, line 10 of section 3.1.4:
$n \times k$ should read: $n \times q$.
[*Brian Taylor 6/88*]

Page 70, line 4:
Omit "we outlined above,"
[*Michael Frigge 4/19/88*]

Page 70, line 9 of Section 3.1.5:
Place the following footnote after the phrase, "that first position must contain $\sqrt{n}$."
. . . or $-\sqrt{n}$. The sign here is chosen by convention, and is an exception to the rule for choosing the sign of s given on page 67. It is an interesting exercise to determine just how much cancellation can occur by adopting this convention. (The answer is "not much.")
[*Mark Levenson, Craig Borkowf 4/5/90*]

Page 70, line -13:
Change TSS to SST
[*RT 4/25/2004*]

Page 71, line 15:
X_1^* should be x_1^*.
[*David Scott 5/6/88*]

Page 71, line 22:
Omit comma following $X_*^{(1)}$
[*Ernesto M. Flores-Roux 4/6/90*]

Page 71, line 25:
Replace J by j
[*Ernesto M. Flores-Roux 4/6/90*]

Page 73, Algorithm MGS:
Omit **begin** and **end** wherever they appear, and indent the five lines that remain following the first line of the algorithm.
[*RT 4/6/90*]

Page 73, Algorithm MGS:
Following the computation of r_{jj}, the procedure should halt if $r_{jj} \leq 0$.
[*Ming Long Lam 8/18/93*]

Page 73, Algorithm MGS:

The upper limit of the summation in the inner loop (that is, in the computation of r_{jk}) should be n rather than p.

[*Ming Long Lam 8/18/93*]

Page 73, line -9:

Change Björck to Bjørck

[*RT 1988*]

Page 74, Exercise 3.3:

The exercise should be omitted. The result to be shown is not true in general.

[*Charles Stein, 1988; Douglas M. Bates, 2/10/92*]

Page 74, Exercise 3.6:

Replace "rotation" by "orthogonal", and "x" by "x".

[*RT 4/9/92*]

Page 74, Exercise 3.10:

$H^{(x)}$ should be replaced by $H_t^{(x)}$ twice.

[*RT 4/7/92*]

Page 75, Exercise 3.14:

"t-statistic" should be singular.

[*RT 1/8/88*]

Page 75, Exercise 3.15:

"which" should be "that"

[*RT 4/9/92*]

Page 75, Expression (3.2.2):

Omit comma at the end of this expression.

[*Ernesto M. Flores-Roux 4/9/90*]

Page 76, line 3:

Add at the end of this paragraph:

> Such a factorization is variously referred to as an LR or LU *decomposition* (the U standing for upper triangular).

Also, add an index entry for LU decomposition.

[*RT 1988*]

Page 77, line 9:

Omit comma after Van Loan, and insert left parenthesis before 1983.

[*Ernesto M. Flores-Roux 4/9/90*]

Page 77, line 14:

Change $n - p \times p$ to read $(n - p) \times p$.

[*Hiro Minato 4/12/90*]

Page 77, line -9:

Should read: "... and (implicitly) *an* orthogonal basis ...."

[*Michael Frigge 4/19/88*]

Page 78, expression (3.2.8):

Replace "=" by ":=" twice, omit **begin** and **end**, and move the period to follow t_{kk} in the last line.

[*RT 4/6/90*]

Page 78, line 1:
Transpose should be on the second term, that is, $(X_1^{*-1})(X_1^{*-1})'$.
[*David Scott 5/6/88*]

Page 78, lines 4–5:
Replace "columns" by "rows" in this paragraph.
[*RT 2/21/2005*]

Page 78, line 18:
$(X_1^*)'$ should be X_1^{*-1}
[*Michael Frigge 6/28/93*]

Page 78, line -2/3:
Change "in $\mathcal{R}^{p+1}$; here ..." to read "$\mathcal{R}^{p+1}$, where ...."
[*Ernesto M. Flores-Roux 4/9/90*]

Page 78, line -5:
Delete "such"
[*Michael Frigge 4/19/88*]

Page 79, line 10:
Change x_is to x_i's.
[*Ernesto M. Flores-Roux 4/9/90*]

Page 79, line 3 after (3.2.9):
Change "is is" to "it is."
[*Ernesto M. Flores-Roux 4/9/90*]

Page 79, Expression (3.2.10):
Add a period at the end of this expression.
[*Ernesto M. Flores-Roux 4/9/90*]

Page 79, line -3:
Change i-th to ith.
[*Ernesto M. Flores-Roux 4/9/90*]

Page 81, Exercise 3.22:
Change both occurences of "which" to "that" and omit the (only) comma.
[*Ernesto M. Flores-Roux 4/9/90*]

Page 81, line 10 of section 3.3:
Add period after "*Cholesky triangle*"
[*RT 1988*]

Page 82, line 2:
Change "it is it" to "it is".
[*Hiro Minato 4/12/90*]

Page 82, line -7:
Change "non-negative" to "nonnegative".
[*Ernesto M. Flores-Roux 4/9/90*]

Page 82, line -2:
Change s to S.
[*Ernesto M. Flores-Roux 4/9/90*]

Page 83, expression (3.3.3):
Insert comma between the first equation and the notation $i < j$.
[*Ernesto M. Flores-Roux 4/9/90*]

Page 83, expression (3.3.4):
Omit **begin** and **end**, and move the period to follow s_{ii} in the last line.
[*RT 4/6/90*]

Page 85, lines -4–6:
Should read:

> In this context, it is particularly easy to compute simultaneously the regressions of a set of q responses Y on a common set of p predictors X.

[*Hal Stern 5/9/88*]

Page 86, third line after (3.4.1):
"square" should be "squares"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 87, 88, 90, and 91, Exercises 3.31 and 3.32; elsewhere:
The font for the SWEEP and SWEEP^{-1} operators is wrong. Should be roman type.
[*Peter McCullagh 3/14/88*]

Page 87, line 4:
Change *k-th* to k*th*
[*Ernesto M. Flores-Roux 5/9/90*]

Page 88, third line after (3.4.6):
"require" should read "requires"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 89, last line of section 3.4.3:
Insert the word, "the" before "construction"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 90, displayed expressions following (3.4.8):
The first line of the display should have the comma following the fraction instead of in the denominator. The second line of the display (defining $s_{0j}^{(0)}$) should replace i on the right side by j.
[*Ernesto M. Flores-Roux 5/9/90*]

Page 90, line -2:
Following the word "preferable", omit the following comma and the word "then". The correction reads, "...; it is preferable to perform...."
[*Ernesto M. Flores-Roux 5/9/90*]

Page 91, line 8:
"depend" should read "depends"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 91, Exercise 3.37:
Omit period after "(Dempster, 1969)"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 92, line 3:
"$p + 1$st" should read "$(p + 1)$-st"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 93, line 5:

Should read: "implies that $u = 0$ when forming H_k!"

[*Hal Stern 5/9/88*]

Page 94, line 7:

S_{ik} should read s_{ik}.

[*Ernesto M. Flores-Roux 5/9/90*]

Page 96–97, 5 lines above Equation (3.5.5) through line 1 of page 97:

There is an egregious error in the exposition leading up to a formal development of the SVD. The error is in a "motivational" section and resulted from mis-transcribing the text from notes. The misstated "result" is not used anywhere else, and does not affect any subsequent development. Indeed, a careful, correct development is given in full in section 3.9.2. The text here should read as follows:

> The answer to this question is (almost) affirmative. There always exists an orthogonal $p \times p$ matrix V for which $\tilde{X}^* V = D$, where D is a diagonal matrix with non-negative elements. But while $\tilde{X}^*$ has the form $U'X$, *this* U does not convert X into upper triangular form as before. Instead, this orthogonal transformation U transforms X so that we may write
>
> $$\begin{aligned} Y^* &= (U'X)\beta + \epsilon^* \\ &= \tilde{X}^*(VV')\beta + \epsilon^* \\ &= \begin{pmatrix} D \\ 0 \end{pmatrix} \theta + \epsilon^*, \end{aligned} \tag{3.5.5}$$
>
> where $\theta = V'\beta$.

[*Alan J. Miller 7/11/88*]

Page 97, line 12 ("...called the *singular values*..."):

Omit the comma after V

[*Ernesto M. Flores-Roux 5/9/90*]

Page 97, line 18:

"least-square" should be "least-squares"

[*Ernesto M. Flores-Roux 5/9/90*]

Page 97, line -2:

$\hat{\theta}$ should read $\hat{\theta}_i$

[*Ernesto M. Flores-Roux 5/9/90*]

Page 98, lines 19–21:

These sentences should be changed to read

> The matrix U in the SVD rotates and/or reflects the points in variable space. Since these operations preserve the sizes of angles, the new (reconfigured) points retain their correlation structure.

[*RT 4/16/92*]

Page 99, line 4:

"singular values" should not be hyphenated here.

[*Ernesto M. Flores-Roux 5/9/90*]

Page 99, line -8:

Omit comma after "that"

[*Ernesto M. Flores-Roux 5/9/90*]

Page 101, Theorem 3.5–2:
The first line should read, "Let X be a $p \times p$ nonsingular matrix,..."
[*Ernesto M. Flores-Roux 5/9/90*]

Page 102, line 13:
the line should begin "by $SST = |Y|^2 = SSM + SSR$." (The definition of SST is what's new.)
[*Ernesto M. Flores-Roux 5/9/90*]

Page 103, line 8:
"floating-point" needs to be hyphenated
[*Ernesto M. Flores-Roux 5/9/90*]

Page 103, Section 3.5.5:
Omit the period after the section title
[*Ernesto M. Flores-Roux 5/9/90*]

Page 104, line 13:
Omit "that"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 104, line 25:

The definition of $\mathcal{D}^+$ should be transposed, that is, $\mathcal{D}^+ = \begin{pmatrix} D^{-1} \\ 0 \end{pmatrix}'$.

[*David Scott 5/6/88*]

Page 104, line -5:
Change "which has" to "that has".
[*RT 4/26/90*]

Page 105, equation (3.5.12) and 5 lines after (3.5.12):
Change U to U'
[*RT 4/21/92*]

Page 105, throughout:
Omit the tilde from $\tilde{X}$
[*RT 4/21/92*]

Page 106, exercise 3.45:
Omit the comma after $\mathcal{R}^n$
[*Ernesto M. Flores-Roux 5/9/90*]

Page 106, exercise 3.48:
X^+ should be defined as $V(\mathcal{D}^+)'U'$
[*Ernesto M. Flores-Roux 5/9/90*]

Page 106, Exercise 3.55:
Insert σ^2 before $(X'X)^+$
[*RT 4/21/92*]

Page 109, line 6 of Comment:
Change semicolon to colon
[*Ernesto M. Flores-Roux 5/9/90*]

Page 110, line 11:
Omit period after "models"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 111, lines 12–14:
Change "*must* reduce" to read "*cannot* increase"
[*Walter Ambrosius 4/21/92*]

Page 112, line 8:
Move the comma inside the quotation marks around "small"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 113, line -10:
Insert hyphen in "*ki*-th"
[*RT 11/27/90*]

Page 113, line -2:
"sum of squared errors loss" should read "sum-of-squared-errors loss"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 114, line 2:
"*index*" should be "*index*)"
[*Ernesto M. Flores-Roux 5/9/90*]

Page Exercise 3.59, line 2:
Omit "that"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 116, line 5:
Insert the word "data" after the word "adding"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 116, line -19:
"formulae" should read "formulæ"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 117, second line after (3.7.1):
change *i*-th to *i*th
[*Ernesto M. Flores-Roux 5/9/90*]

Page 117, line -18:
omit "and" after the semicolon
[*Ernesto M. Flores-Roux 5/9/90*]

Page 118, line 3:
Add space between "formulæ" and "directly"
[*Brian Taylor, 6/88*]

Page 119, line 6:
"methods" should read "method"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 120, line 8:
After the word "unique," add: "up to a choice of sign."
[*Peter McCullagh 3/14/88*]

Page 120, Second paragraph of Comment.:
The last sentence should be replaced by "The lengths of the axes of this ellipsoid are inversely proportional to the square roots of the eigenvalues of A."
[*Peter McCullagh 3/14/88*]

Page 121, line -14:
"singular-value" (add hyphen)
[*Ernesto M. Flores-Roux 5/9/90*]

Page 122, line 3:
Insert period after $\hat{\Sigma} = \hat{\Gamma}'\hat{\Lambda}\hat{\Gamma}$
[*Ernesto M. Flores-Roux 5/9/90*]

Page 123, line 6:
"singular-value" (add hyphen)
[*Ernesto M. Flores-Roux 5/9/90*]

Page 128, line 2:
Replace comma by semicolon at the end of the line
[*Ernesto M. Flores-Roux 5/9/90*]

Page 128, line -8:
Change "QR" to "QR" (for consistency)
[*Ernesto M. Flores-Roux 5/9/90*]

Page 129, lines 1 and 4 of 3.9.2:
Hyphenate "singular value"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 133, 7 lines above section 3.9.4:
Hyphenate "singular value"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 134, line -14:
Hyphenate "singular value"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 135, exercise 3.81:
The reference to Lawson and Hanson should follow the difficulty rating.
[*Ernesto M. Flores-Roux 5/9/90*]

Page 135, last line:
Change "that" to "then"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 136, line 1:
Change "which" to "that".
[*Ernesto M. Flores-Roux 5/9/90*]

****Page 136, Exercise 3.85:**
Change $S(Q'AQ) - S(A)$ to $S(A) - S(Q'AQ)$.
[*RT 10/20/08*]

Page 141, line 21:
GLS should read GLS
[*Ernesto M. Flores-Roux 5/9/90*]

Page 142, lines 2–5:

The sentence beginning, "More generally, . . . " isn't clear. It should be replaced by: "More generally, the form of the variance function $v(\cdot)$ may also change from iteration to iteration. For instance, it is often easiest to take $v(\cdot) \equiv 1$ on the first iteration (only). If approximations to $v(\cdot)$ are less expensive to compute than exact expressions, the former can be used for early iterations."

[*Peter McCullagh 11/11/91*]

Page 142, lines 7–13:

The order of these three sentences can leave an erroneous impression about the asymptotic variance in GLIM models. The sentences should be reordered, and the final sentence below added, to read: "Under fairly mild conditions, . . . , the matrix $\hat{\sigma}^2(X'\hat{V}^{-1}X)^{-1}$ will be asymptotically equivalent to the variance matrix of $\hat{\beta}$. The method is quite generally useful in solving nonlinear estimation problems; detailed discussion is deferred to Section 4.5.6. For instance, IRLS methods are used in the GLIM computer package. Generalized linear models permit the mean μ and the linear predictor $\eta \equiv X\beta$ to be related by a functional relationship $\eta = g(\mu)$; in this case the variance matrix of $\hat{\beta}$ is asymptotically equivalent to $\hat{\sigma}^2(\partial\mu/\partial\eta)'(X'\hat{V}^{-1}X)^{-1}(\partial\mu/\partial\eta)$."

[*Peter McCullagh 11/11/91*]

Page 142, exercise 3.90, line 2:

Remove hyphen from "least-squares"

[*Ernesto M. Flores-Roux 5/9/90*]

****Page 143, Equation (3.11.2):**

The word "*sum*" should be replaced by a summation sign, so that the equation reads

$$\beta_i = \frac{1}{a_{ii}}\,(c_i - \sum_{j \neq i} a_{ij}\beta_j), \tag{3.11.2}$$

[*David Scott 5/6/88*]

****Page 144, line 10:**

The LU decomposition referred to here should be the LR decomposition, for consistency with the rest of the book. **[Revision standardizes on LU terminology.**

[*Sandy Weisberg 4/12/88*]

****Page 146, Exercises 3.94 and 3.95:**

The proof in the back of the book works only if complex eigenvectors are allowed. These exercises need some work.

[*RT 4/28/92*]

****Page 149, line -3:**

Replace "residuals" by "errors".

[*Stephen Stigler 6/8/88*]

****Page 150, Equation (3.12.5):**

Insert $\sum_{i=1}^{n}$ after $\equiv$ on the right-hand side.

[*Brian Taylor, 6/88*]

****Page 150, Equation (3.12.7):**

Omit "2" from denominator on left-hand side.

[*Stephen Stigler 6/8/88*]

Page 150, line -2:

Replace "exactly that" by "in the form"

[*Stephen Stigler 6/8/88*]

Page 151, line 6 after Equation (3.12.8):

Add after "...LAV estimator.":

IRLS is examined in detail in Section 4.5.6.

[*Stephen Stigler 6/8/88*]

Page 159, line 6:

Add a prime to the vector so that it now reads $(\theta_1, \ldots, \theta_p)'$

[*Sergio Chayet 4/30/92*]

Page 160, Exercise 4.4:

At the end of the second sentence, insert ", where the components of X are independent random variables"

[*Segio Chayet 4/30/92*]

Page 164, lines 12–13 of Section 4.2.2:

The sequence exhibits convergence of order β:

provided that $\epsilon_i \to 0$ and $\epsilon_{i+1}/\epsilon_i^{\beta} \to c$

[*Stephen Stigler 6/8/88*]

Page 169, line 16:

"Table 4.3.3" should read "Table 4.2.3"

[*Sandy Weisberg 4/18/88*]

Page 170, line 4 of Algorithm 4.2.4:

"$d_1 := f_1 - f_2$" should read "$d_1 := f_1 - f_0$"

[*Yinxiao Huang 11/12/07*]

Page 174, line 2:

The term "finite differences" should be followed by a reference to Section 4.4.

[*Sandy Weisberg 4/18/88*]

Page 174:

Should read: "will correspond to a *local* maximum ...."

[*Stephen Stigler 6/8/88*]

Page 179, Exercise 4.10:

Insert $f'(x)$ before "does not change sign"

[*Walter Ambrosius, 4/27/92*]

Page 180, Exercise 4.17:

$g(\theta)$ should be $f(\theta)$

[*Qi Zhang 4/30/92*]

Page 181, line -10:

Should read: "we write $f'(x)y$."

[*Hal Stern 5/9/88*]

Page 182, line 8:

Delete "the solution to"

[*Brett Presnell 6/19/96*]

Page 182, line 6 of Section 4.3.2 (Clarification):

After the sentence ending "... becomes the next iterate." add:

> Equivalently, Newton-Raphson approximates F by a quadratic surface—the two-term Taylor series—and then uses the maximum or minimum on this surface as the next iterate.

[*Sandy Weisberg 4/18/88*]

Page 184, line 15:

Delete comma after $\{h_j\}$.

[*Brian Taylor, 6/88*]

Page 188, Section 4.3.5 title:

Change "statististical" to "statistical"

[*RT 1/8/88*]

Page 189, equation (4.3.9):

p in the denominator of the first term on the right side of the equation should be ξ

[*Emmanuel Lazaridis 4/30/92*]

Page 192, line 4 of section 4.3.5.2:

Reference to Thisted and Efron should be 1987.

[*RT 5/10/88*]

Page 192, lines 8–10:

The indices k and x should be replaced by j, so that the lines read:

> We take each y_j to have a Poisson distribution with parameter λ_j. A model for the Shakespearean canon presented by Thisted and Efron predicts a mean number of such words to be ν_j. For $j = 1, 2, \ldots, 99$ we take $\log(\lambda_j) = \log(\nu_j) + \alpha + \beta \log(j + 1)$.

[*Sandy Weisberg 4/18/88*]

Page 193, equation (4.3.18):

Add a comma after $\beta' x_j$

[*Ernesto M. Flores-Roux 5/9/90*]

Page 193, equation (4.3.20):

Equation should end with a period.

[*Ernesto M. Flores-Roux 5/9/90*]

Page 193, equation (4.3.21):

The second summation should read "$\sum_{j=1}^{k} n_j \log\left(1 + e^{-\beta' x_j}\right)$" (the n_j was omitted).

[*Yinxiao Huang 11/12/07*]

Page 194–195, throughout both pages:

Replace "gender" by "sex"

[*RT 5/5/92*]

Page 197, line 17:

"Section 4.3.4.1" should read "section 4.3.3.1"

[*David van Dyk 4/10/96*]

Page 198, line -17:

Replace comma after "iteration" by a semicolon

[*RT 5/01*]

Page 207, line -14:

The phrase "whenever $\lambda > \lambda_{min}$" should read, "whenever $\lambda > \max(-\lambda_{min}, 0)$." If F'' is positive definite, then this condition is just $\lambda > -\lambda_{min}$.

[*Peter McCullagh 3/14/88*]

Page 212, equation (4.5.5):

Replace "$-2(A + G)$" by "$A + G$".

[*Hal Stern 5/9/88*]

Page 213, line -9:

Interchange space and comma after Schnabel.

[*Peter McCullagh 3/14/88*]

Page 217, line 3 of Comment:

"generalized linear model*s*." (plural).

[*RT 3/27/90*]

Page 217, line -3:

Omit second right parenthesis in definition of w_i.

[*RT 3/27/90*]

Page 220, four lines after Section 4.5.7.2:

"β is $p \times 1$," not $p \times p$.

[*David Scott 5/6/88*]

Page 224, line 14:

The alleged hat matrix should read: $X(X'X)^{-1}X'$.

[*Hal Stern 5/9/88*]

Page 226, Exercise 4.42:

"the smallest eigenvalue" should read "the negative of the smallest eigenvalue"

[*RT 5/12/92*]

Page 227:

Reference to Efron and Diaconis should be to Diaconis and Efron.

[*RT 10/19/90*]

Page 230, line -12:

Should read "$E(y_i \mid x_{i1}) = f_{10}(x_{i1})$".

[*David Scott 5/6/88*]

Page 240, equation (4.7.1):

$f(z_m)$ should be omitted from the integrand.

[*William M. Sallas 9/1/09*]

Page 243, Exercise 4.70:

The difficulty level should be reduced to 45, in light of progress made on this problem. See Elashoff and Ryan (2004) *JCGS*.

[*RT 9/11/09*]

Page 260, line 1:

Add period after "...Kahaner, 1983)"

[*Brian Taylor, 6/88*]

Page 260, line -6:
Table number should be 5.1.1 instead of 5.1
[*RT 5/18/2004*]

Page 261, Table 5.1.1:
Remove indentations preceding $\mathcal{S}_n$ and $\mathcal{C}^n$.
[*Peter McCullagh 3/14/88*]

Page 265, line 13:
Change $|E_j|$ to E_j
[*Michael Frigge 6/1/89*]

Page 265, lines 22–23:
Change I_{j+1} to $|I_{j+1}|$ in both lines.
[*Michael Frigge 6/1/89*]

Page 268, 7 lines above equation (5.1.10):
Change "approximation stop" to read "approximation be stopped"
[*Brian Taylor, 6/88*]

Page 268, 2 lines above equation (5.1.10):
Should read:
... and let h here denote $(b-a)/n$, the distance between evaluation points used to obtain I_j.
[*Brian Taylor, 6/88*]

Page 270, equation (5.1.12):
Change $\left(\frac{2}{n}\right)^2$ to $\left(\frac{2(b-a)}{n}\right)^2$.
[*Yinxiao Huang 11/12/07*]

Page 270, equation (5.1.13):
Change $\left(\frac{1}{n}\right)^2$ to $\left(\frac{b-a}{n}\right)^2$.
[*Yinxiao Huang 11/12/07*]

Page 275, line -10:
Should read: "step size increase*s*"
[*Michael Frigge 6/8/89*]

Page 276, line 2 of section 5.2.2:
Change "which" to "that"
[*RT*]

Page 277, line -7:
Change "faster" to "slower"
[*RT 5/22/2004*]

Page 279, Exercise 5.24:
Change "for the evaluating" to "for evaluating"
[*RT 5/19/2004*]

Page 289, line 18:
Change the reference from "Press, Flannery, Teukolsky, and Vetterling (1986)" to "Piessens, de Doncker-Kapenga, Überhuber, and Kahaner (1983)"
[*John Bennett, 5/28/93*]

Page 295, Equation (5.5.2):
Should read: $x_1 \leq x < x_2$.
[*Hal Stern 5/9/88*]

Page 297, line 16:
Definition of periodic spline should have $0 \leq k \leq n-1$.
[*Hal Stern 5/9/88*]

Page 298, line 12 (entry for $\phi(1.7)$):
Replace 0.094049077376887 by 0.094090773768869
[*RT 2/9/2005*]

Page 300, lines 1–2:
Replace "which they produce" by "that it produces"
[*RT 3/27/90*]

Page 303, line −15:
Replace "is" by "are" after "these possibilities"
[*RT 2/9/2005*]

Page 307, line 2:
Update Shaw reference to 1988 *Annals of Statistics* paper.
[*RT 3/27/90*]

Page 307, Exercise 5.68:
"(continued)" should be "(Continuation)"
[*RT 4/25/2004*]

Page 313, line 6 of section 5.7.4:
Update Evans and Swartz (1986) to (1988b).
[*RT 11/7/91*]

Page 314, line 8:
Add the following paragraph after the existing first paragraph:

> For $\mu = 0$ and $k = 2$, the positive orthant probability is $\arccos(-\rho/2\pi)$, where ρ is the correlation coefficient. For $\mu = 0$, $k = 3$, and correlations ρ_{ij}, the positive orthant probability is $[\arccos(-\rho_{12}) + \arccos(-\rho_{13}) + \arccos(-\rho_{23}) - \pi]/(4\pi)$. (Reference: Plackett, R. L. (1954). "A reduction formula for normal multivariate integrals," *Biometrika* **41**, 351–360.)

[*RT 1989*]

Page 314, line 16:
Add the following paragraph after the existing paragraph:

> For $\mu \neq 0$ and $k = 2$, algorithms are available. Donnelly (1973) gives an algorithm that permits computation of bivariate probabilities over rectangular regions. (Reference: Donnelly, T. G. (1973). "Algorithm 462: Bivariate normal distribution," *Communications of the ACM,* **16**, 638.)

[*RT 1989*]

Page 314, line 17:
Update Evans and Swartz reference to (1988a).
[*RT 11/7/91*]

Page 319, Problem 5.76:
The problem should refer to expression (5.8.6), not (5.8.5).
[*Hal Stern 5/9/88*]

Page 321, equation (5.9.1):
Insert a comma at the end of the equation.
[*RT 4/18/2004*]

Page 325, line -10ff:
This sentence should be reworded to read, "Because it is an S-fraction, (5.9.7) has successive errors that alternate in sign and whose magnitudes are monotone decreasing, so that the difference in size of successive terms can be used reliably to monitor convergence."
[*RT 4/18/2004*]

Page 326, Equation 5.9.9:
The third term in the continued fraction should read

$$\frac{-2 \cdot 3}{x^2 + 7}$$

[*Peter McCullagh 3/14/88*]

Page 333, line -8:
Delete "the that of"
[*Brian Taylor, 6/88*]

Page 334, line above equation (5.10.15):
The line should read:
smaller n; it is given by the slightly more complicated formula
[*RT 1/28/88*]

Page 334, Equation (5.10.15):
Insert $\pm$ in front of right-hand side of the equation
[*RT*]

Page 346, Equation (6.2.5):
Summation is over $j \in N_i$, not $j \in N_I$.
[*Hal Stern 5/9/88*]

Page 347, line 20:
Change $\exp(t^2/2)$ to $\exp(-t^2/2)$.
[*RT 5/30/2004*]

Page 347, line -1:
Italicize "smoothers" at end of sentence.
[*Ernesto M. Flores-Roux 4/6/90*]

Page 351, line 9 :
Change "Methods which" to "Methods that"
[*RT 11/20/91*]

Page 351, line 12 :
Change "derivates" to "derivatives"
[*RT 4/15/2004*]

Page 351, line -16 :
"posterior mean value" should read "posterior mode"
[*Mark Levenson, 11/20/91*]

Page 360, line -9:
Delete the word "a" before "measurements"
[*Ernesto M. Flores-Roux 4/6/90*]

Page 360, line -3:
Should read: "The hazard function ...."
[*Hal Stern 5/9/88*]

Page 361, line 1:
Should read: " ... then we write ... "
[*Zettel, 8/89*]

Page 363, answer 2.12:
Capitalize reference to Algorithm 2.3.1.
[*Hiro Minato 4/2/90*]

Page 364, answer 2.30:
Change $\bar{X}$ to $\bar{x}$. (twice)
[*Hiro Minato 4/2/90 (and Bruce McCullough fixed the Errata page number!)*]

Page 367, Answer to 3.55:
$V(\hat{\beta})$ should be $\text{Var}(\hat{\beta})$; $V(X^+Y)$ should be $\text{Var}(X^+Y)$; insert σ^2 after the second, third, fourth, and fifth equality signs
[*RT 4/21/92*]

Page 368, Answer to 3.70:
Omit period and spaces at beginning of answer.
[*RT 4/17/2004*]

Page 373, Answer to 4.16:
Add a citation to Ferguson, Thomas S. (1978), "Maximum likelihood estimates of the parameters of the Cauchy distribution for samples of size 3 and 4," *Journal of the American Statistical Association*, **73**, 211–214. Ferguson derives closed-form expressions for the joint maximum likelihood estimates of location and scale in Cauchy samples of size 3 and 4, and conjectures that no such expressions exist for larger sample sizes.
[*Stephen Stigler 6/8/88*]

Page 373, Answer to 4.16:
Also, possibly of interest is Z. D. Bai and J. C. Fu (1987), "On the maximum-likelihood estimator for the location parameter of a Cauchy distribution, " *Canadian Journal of Statistics*, **15**, 137–146. [RT hasn't yet read this one.]
[*RT 3/27/90*]

Page 376, Answer to 4.42, last sentence:
"the smallest eigenvalue of A" should be replaced with $-ch_{\min}(A)$.
[*RT 5/12/92*]

Page 380, Answer to 5.7:
Change $f(x-1)$ to $f(x_1)$
[*Brian Taylor, 6/88*]

Page 381, Answers to 5.14–5.16:

The estimate $\hat{k}_{n-1}$ is all wet (or mostly so, anyway). If we assume that the error at stage i and step size h_i is ch_i^k, then $\rho_i \equiv (I_n - I_{n-1})/(I_n - I_{n-2}) = 1/(2^k + 1)$, assuming that $h_i = h_{i-1}/2$. This leads to the estimate $\hat{k} = \log_2(\rho_i^{-1} - 1)$ instead of the cited estimate $-\log_2(\rho_i)$. This changes the numerical results, making the empirical estimates much closer to the true values.

[*Nicholas J. Higham, 3/20/90*]

Page 382, Answer to 5.24:

Change $(-\log(t))^{-1/2}$ to read $(-t\log(t))^{-1/2}$

[*RT 5/22/2004*]

Page 384, Answer to 5.44:

Change variable of integration from x to t.

[*RT 2/20/2001*]

Page 390, Entry for Bentley and Cooke:

Year of publication was 1973, not 1974.

[*Susan Groshong 9/26/88*]

Page 391, Reference to Björck:

Change Björck to Bjørck

[*RT 1988*]

Page 392:

Reference to (Cody, *et al,* 1984) found on pages 37 and 59 is missing from references. Reference should be Cody, W. J., *et al* (1984). A proposed radix- and word-length-independent standard for floating-point arithmetic. *IEEE Micro,* **4**, 86–100.

[*RT*]

Page 395:

Evans and Swartz (1986) technical report was published. The reference is (1988a), *Journal of Statistical Computation and Simulation,* **30**, 117–128.

[*RT 11/7/91*]

Page 395:

Evans and Swartz (1987) article in press was published in later year. The reference is (1988b), *SIAM Journal of Scientific and Statistical Computing,* **9**, 950–961.

[*RT 11/7/91*]

Page 404, Entry for Press, *et al*:

Add a comma after "William H."

[*RT 1989*]

Page 406, Shaw entry:

Technical report has appeared as Shaw (1988) *Annals of Statistics,* **16**, 895–914.

[*RT 1988*]

Page 408, Thisted (1987):

"resgression" should be "regression"

[*RT 9/13/90*]

Page 415:

Insert entry for "Extended precision"

[*RT Date unknown*]

Page 416, Entry for Gauss, Carl Friedrich:
Add entry for page 117.
[*Stephen Stigler 6/8/88*]

Page 417, column 1, line -3:
Change "Green, P. J." to "Green, Peter James". Also, omit second citation of page 219.
[*RT 1989*]

Page 417, column 2, line 21:
Interchange references to pages 391 and 398 for Hastie entry.
[*RT 1989*]

Page 419, column 2, line 30:
Change entry for LR decomposition to "75–76."; Add entry "LU decomposition ≡ LR decomposition."
[*RT 1989*]

Page 423, column 2, line 23:
Insert page reference 224 to "Scoring, method of"
[*RT 9/23/91*]

Page 423, column 2, line -13:
Insert page number 25 into self-referential entry.
[*RT 4/4/88*]

Page 424:
Change "Singular value decomposition" to "Singular-value decomposition"
[*Ernesto M. Flores-Roux 5/9/90*]

Page 425, column 2, line 13.2:
Move "Thisted, Barbara" behind line 13
[*RT 4/24/2004*]

Page 425, column 2, line 13.4:
Move "Thisted, Dale" behind "Thisted, Barbara"
[*RT 4/24/2004*]

Page 425, column 2, line 13.5:
Insert entry: "Thisted, Linda Jeane Soder, v."
[*RT 1/8/88*]

Page 426, Index entry for Walker, Isabelle:
Change to "Isabelle Margaret"
[*RT 1/8/88*]

Page 426, Index entry for Wallace, David:
Change "Lew" to "Lee"
[*RT 11/8/91*]
